

KOREAN INTELLECTUAL PROPERTY OFFICE

This is to certify that the following application annexed hereto is a

true copy from the records of the Korean Industrial Property Office.

Application Number: Patent Application No. 2002-0083399

Date of Application: December 24, 2002

Applicant(s): LG Electronics Inc.

COMMISSIONER

[ABSTRACT OF THE DISCLOSURE]

[ABSTRACT]

Disclosed is a digitizer, which includes a sensor board formed in a plane state, an LCD panel for displaying a picture image on the sensor board, a polyethylene-terephthalate (PET) film on the upper surface of the LCD device, thereby providing a slim dimension and light-weighting of the digitizer and preventing the stylus pen from being slipped on the polyethylene-terephthalate (PET) film, thereby making a user comfortable in writing.

[TYPICAL DRAWING]

FIG. 8

[INDEX WORDS]

Polyethylene Terephthalate

[SPECIFICATION]

[TITLE OF THE INVENTION]

DIGITIZER

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 is a schematic view illustrating a related art resistive type or a capacitive type digitizer;

FIG. 2 is a cross-sectional view illustrating a related art electromagnetic type digitizer;

FIG. 3 is a circuit diagram schematically illustrating a sensor board and a stylus pen in the related art electromagnetic type digitizer;

FIG. 4 illustrates an operational principle of a digitizer;

FIG. 5 illustrates an output waveform for a position recognition of a digitizer;

FIG. 6 is a cross-sectional view illustrating a related art LCD panel;

FIG. 7 is a cross-sectional view illustrating a related art digitizer;

FIG. 8 is a cross-sectional view illustrating an LCD device according to the present invention; and

FIG. 9 is a cross-sectional view schematically illustrating an LCM according to the present invention.

Reference numerals of the essential parts in the drawings

101: sensor board	102: LCD
103: Polyethylene Terephthalate film	104: top case
105: stylus pen	106: shield plate
107: connector	108: digitizer board
109: driving circuit	110: LCM
111: backlight	

112a, 112b: first and second polarizing plate
113: gate electrode 114: gate insulating layer
115: semiconductor layer
116a, 116b: source/drain electrodes
117: passivation layer 118: pixel electrode
119a, 119b: first and second orientated film
120: lower substrate 121: black matrix layer
122: color filter layer 123: common electrode
124: upper substrate 125: liquid crystal layer
126: patterned spacers

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]

The present invention relates to a digitizer, and more particularly, to a digitizer on which a liquid crystal display device (hereinafter referred to as 'LCD') is mounted and Polyethylene Terephthalate film is coated over an upper surface of the LCD, for making a user comfortable in writing and providing a slim dimension and light-weighting of the digitizer.

In general, a digitizer is mounted on a display device of a notebook computer, which serves as an input device for position information by a user without an additional keyboard or mouse. The digitizer has been used for a graphic process such as CAD.

The aforementioned digitizer is referred to as a touch screen, a tablet or an electric graphic input panel (EGIP) and can be classified into into a resistive type, a capacitive type, and an electromagnetic type depending upon a sensing method when a user touches a display surface.

A resistive type digitizer according to the related art will be described with reference to the accompanying drawings. FIG. 1 is a schematic view illustrating a resistive type digitizer according to the related art.

As shown in FIG. 1, the resistive type digitizer according to the related art includes a film 1 on which an upper transparent electrode (not shown) is formed, a lower substrate 2 on which a lower transparent electrode (not shown) is formed and a spacer 5 formed between the upper film and the lower substrate 1 and 2 for maintaining an interval therebetween.

In the resistive type digitizer, when a portion of the upper film 1 is touched with a finger 3 or a pen 4 at a predetermined pressure, the transparent upper electrode formed on the upper film 1 and the transparent lower electrode formed on the lower substrate 2 are in contact with each other. As a result, a controller (not shown) reads a voltage value variable by a resistance value of a touching point, thereby detecting coordinates of the touching point.

FIG. 2 is a cross-sectional view illustrating a related art electromagnetic type digitizer.

Referring to FIG. 2, the digitizer includes a sensor board 6 formed plane for recognizing two dimensional position by forming an electromagnetic field and sensing the same; a stylus pen for inputting position information on the sensor board 6; a shield plate 8 is formed of a metal material below the sensor board 6 for excluding the electromagnetic wave generated from the stylus pen 7 and the sensor board 6; an adhesive 9 for insulating the shield plate 8 and the sensor board 6 and adhering therebetween; and a digitizer board 11 connected to a connector 10 for operating the sensor board 6.

Although not shown, the stylus pen 7 includes a coil 12 that generates a current

by receiving the electromagnetic field from the sensor board 6, and then generates an electromagnetic wave by the receiving the current and a capacitor 13 that charges and discharges the current generated in the coil 12.

Furthermore, the digitizer board 11 includes a circuit (not shown) for driving the sensor board 6, and a plurality of ICs 11a.

Although not shown, the sensor board 6 includes a plurality of X-axis and Y-axis coils having loop-shaped structures for generating an electromagnetic field by receiving a current from a power source.

Accordingly, the electromagnetic type digitizer detects the position of the stylus pen 7 by using the electromagnetic of the stylus pen 7 and the sensor board 6, so that the direct detection of the stylus pen 7 is obtained. As a result, a user can perform fine and elaborate work on the electromagnetic type digitizer by controlling the thickness and the strength of color.

The electromagnetic type digitizer will be explained in more detail as follows.

FIG. 3 is a circuit diagram schematically illustrating a sensor board and a stylus pen in the related art electromagnetic type digitizer.

Referring to FIG. 3, the sensor board (the reference numeral 6 of FIG. 2) of the electromagnetic type digitizer sequentially inputs AC voltages 16 to the plurality of loop patterns 15 connected to one ground terminal 14, the stylus pen 7 being charged and discharged by the AC voltages 16 is resonated with the electromagnetic field for detecting the accurate position of the touch point. Although not shown, the loop pattern 15 is formed horizontally and at the same time vertically, perpendicular to each other, such like a lattice pattern.

Thus, because the loop pattern 15 and the stylus pen 7 respectively generate a loop-shaped solenoid, in case the current flows into the loop pattern 15, an

electromagnetic field is generated at the direction perpendicular to the loop pattern 15.

In other words, due to the electromagnetic field formed, in pursue of the Lentz's law a loop current is formed on the stylus pen 7 and the coil at the opposite direction to each other.

Also, the stylus pen 7 is resonated with the electromagnetic field, so that the stylus pen 7 holds the resonant frequency for a predetermined time period, and then discharges the resonant frequency. In other words, the resonant frequency is stored in the capacitor 13 of the stylus pen 7 instantaneously, and discharged. Then, the discharged current from the stylus pen 7 generates the electromagnetic field by the loop pattern 15, thereby generating the loop current in the loop pattern 15.

Subsequently, the sensor board 6 switches a terminal to which the AC power source 16 is applied to an operational circuit 17. As a result, the loop pattern 15 of the loop current is sensed and displayed as a coordinate value, which is for detecting a touch point of the stylus pen 7 on a plane surface.

Accordingly, the electromagnetic type digitizer using an electromagnetic induction between the loop pattern 15 of the sensor board 6 and the stylus pen 7 can be illustrated as in FIG. 4.

Referring to FIG. 4, the electromagnetic induction between the loop pattern 15 and the stylus pen 7 in the sensor board 6 is repetitively performed in a short time, so that movement of the stylus pen 7 on the sensor board 6 can be detected. Arrows 18 of the drawing indicate the direction of the electromagnetic field.

Also, a signal intensity of the stylus pen 7 detected through the loop pattern 15 will be described with reference to FIG. 5. A step-shaped signal 19 corresponds to each loop pattern (the reference numeral 15 of FIG. 3), and the peak of the step-shaped signal 19 corresponds to the position of the stylus pen 7. As a result, the electromagnetic type

digitizer detects the correct position of the stylus pen 7 by using the electromagnetic induction of the loop pattern 15 of the sensor board 6 and the stylus pen 7.

FIG. 6 is a cross-sectional view illustrating the related art LCD panel. As shown in FIG. 6, the related art LCD panel includes a thin film transistor T consisted of an electrode 20, a gate insulating layer 21, a semiconductor layer 22 and source/drain electrodes 23a and 23b, a lower substrate 27 including a pixel electrode 25 to which a video signal voltage is applied by switching T, an upper substrate 28 formed to face an opposite direction to the lower substrate 27 and includes a color filter layer 30 for displaying R/G/B color and a common electrode 31, a liquid crystal layer 32 formed between the upper and lower substrates, and a ball spacer 33 formed to maintain a constant interval between the upper and lower substrates.

Although not shown, a backlight is formed below the lower substrate 27 as one unit with the lower substrate 27, for irradiating the light to the LCD, the light being generated from the light source, and first and second polarizing plates are formed on the external surfaces of the upper and lower substrates 27 and 28 for polarizing the light irradiated from a backlight.

Thus, the aforementioned digitizer attached to the LCD device is drawn an attention as an input device.

FIG. 7 illustrates an LCD device integrated with a related art electromagnetic type digitizer. As shown in FIG. 7, the related art digitizer includes the sensor board 6 formed in plane for detecting the position of a stylus pen by detecting the electromagnetic wave from the stylus pen 7, an LCD device 40 for displaying on the sensor board 6, a top case 41 for combining with the LCD 40 and the sensor board 6, passivation substrate 42 is formed in parallel with the LCD device 40 for protecting the LCD device 40, a stylus pen 7 positioned on the upper surface of the passivation

substrate 42, a shield plate formed of a metal material for excluding the electromagnetic wave generated from the sensor board 6, and a digitizer board 11 formed below the shield plate 8, and connected to the sensor board 6 by a connector 10 for driving the sensor board 6.

Herein, the LCD device 40 further includes a liquid crystal module 43 consisted of a liquid crystal layer (the reference numeral 32 of FIG. 6) formed between an upper substrate (the reference numeral 27 of FIG. 6) and a lower substrate (the reference numeral 28 of FIG. 6), first and second polarizing plates 43a and 43b respectively formed on the external surfaces of the upper and lower substrates of the LCM 43, and a backlight 44 formed below the LCD panel 43 for irradiating the light to the LCD panel.

With this configuration, a driving circuit 45 is positioned below the shield plate 8 together with the digitizer board 11, for driving the LCD device 40.

Furthermore, the LCD device includes a sensor board 6, a shield plate 8, and a digitizer board 11. The sensor board 6, the shield plate 8, and the digitizer board 11 are sequentially positioned below the LCD device 40.

Next, the stylus pen 7 includes a coil 12 for inducing the microwave induction between the sensor board 6, and a capacitor 13 for charging and discharging current generated from the coil 12. At this time, a tip of the stylus pen 7, i.e., the point of the stylus pen is formed of a plastic material such as polyacetal,

In this case, a ball spacer (the reference numeral 33 of FIG. 6) is used for maintaining a cell gap between the upper and lower substrates of the LCD device 40. That is, in case of a direct contact between the point of the stylus pen and the LCD device 40, the ball spacer 33 may be moved between the upper and lower substrates by a pressure, thereby generating ripples in the liquid crystal. As a result, the LCD device may be deteriorated. In this respect, it is required to maintain a predetermined distance

'd' between the LCD device 40 and the passivation substrate 42.

For this, a bezel 44 is formed in the circumference of the passivation substrate 42 for securing the passivation substrate 42 to the LCD device. With using the bezel 44, the upper circumference of the LCD device 40 is in contact with the passivation layer 41 and the passivation substrate 42. Thus, the related art digitizer can be moved freely on the passivation substrate 42 which is preferably formed of a glass substrate on the LCD device 40.

However, the LCD device integrated with the electromagnetic type digitizer according to the related art has the following disadvantages.

In case of mounting the related art electromagnetic type digitizer to the LCD device by using the stylus pen, the stylus pen may slide on the surface of the passivation substrate since the passivation substrate is formed of a glass substrate, and the tip of the stylus pen is formed of a plastic material such as polyacetal, so that it is hard to make a user comfortable in writing.

Also, it is required to maintain a uniform cell gap between the LCD device and the passivation substrate, so that the visual difference may cause picture images of the stylus pen and the LCD device. That is, the pointing position of the stylus pen may be different from the pointing position recognized by the user.

In case of mounting the related art electromagnetic type digitizer to the LCD device, a predetermined distance is maintained between the passivation substrate and the LCD device, and the passivation substrate is formed of a glass substrate, so that the total thickness and the weight of the LCD device are increased, thereby lowering a mobility.

[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]

Accordingly, the present invention is directed to a digitizer that substantially

obviates one or more of problems due to limitations and disadvantages of the related art.

Another object of the present invention is to provide a digitizer in which a patterned spacer is formed on an LCD panel, for maintaining a uniform cell gap between the LCD panel and the passivation substrate and forming a polyethylene-terephthalate (PET) film on the upper surface of the LCD device for providing a slim dimension and light-weighting of the digitizer and making a user comfortable in writing.

Additional features and advantages of the invention will be set forth in the description which follows and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[PREFERRED EMBODIMENTS OF THE INVENTION]

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a liquid crystal display device with a digitizer includes: a sensor board for detecting a position of a stylus pen by using an electromagnetic wave; a liquid crystal display device displaying a picture image on the sensor board; a polyethylene-terephthalate (PET) film on the upper surface of the LCD device for enhancing a mechanical and tensile strength and the stylus pen for displaying its position over the polyethylene-terephthalate (PET) film.

Preferably, the LCD device includes patterned spacers for maintaining a uniform cell gap between substrates.

More preferably, the polyethylene terephthalate layer is processed with an antiglare treatment.

More preferably, the passivation layer is processed with a hard-coating layer.

Herein, the digitizer is used with an LCD device including the patterned spacers

maintaining a cell gap between the substrates, thereby minimizing ripples in the liquid crystal when the LCD device is touched with a stylus pen. Also, a polyethylene terephthalate layer is formed on the LCD device for enhancing the mechanical and tensile strength and making a user comfortable in writing and providing a slim dimension in the LCD device.

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

An LCD device with a digitizer according to the present invention will be described with reference to the accompanying drawings.

FIG. 8 is a schematic plan view illustrating an LCD device with an electromagnetic type digitizer according to the present invention.

As shown in FIG. 8, the digitizer according to the present invention includes a sensor board 101 generating an electromagnetic wave and detecting the electromagnetic wave from the stylus pen to detect a position of the stylus pen on a two-dimensional plane, a liquid crystal display device 102 for displaying image on the sensor board 102, a polyethylene terephthalate layer 103 formed on the LCD device 102 for protecting the upper surface thereof, a top case for coupling and protecting the polyethylene terephthalate layer 103, the LCD device 102, and the sensor board 101, and a stylus pen 105 for showing a position of itself on the polyethylene terephthalate layer 103.

Moreover, the digitizer further includes a shield plate 106 formed of a metal material below the sensor board 101, for preventing the electromagnetic wave generated from the sensor 101, a digitizer board 108 located below the shield plate 106 and connected to a connector 107 for driving the sensor, and a driving circuit 109 for driving

the LCD device.

At this time, the LCD device 102 further includes a liquid crystal module (LCM) 43 consisted of a liquid crystal layer injected between an upper substrate (not shown) and a lower substrate (not shown), first and second polarizing plates 112a and 112b respectively formed on the external surfaces of the upper and lower substrates of the LCM 110 for polarizing light irradiated from a backlight 111 to an upper and lower portion of the LCM 110, the light to be perpendicular to each other, and the backlight 111 formed at the back side of the LCM 110 as one unit for irradiating the polarization light to the LCD panel. In other words, a passivation layer 103 made of polyethylene terephthalate film is formed on the second polarizing plate 112b for protecting the LCD panel 102, and since the second polarizing plate 112b of the LCD device 102 is formed in a thin film on the LCM 110, the passivation layer 103 made of polyethylene terephthalate film and the second polarizing plate 112b are supported by the upper substrate in a plane state.

The passivation layer 103 is formed of a polyethylene terephthalate (PET) film, and the mechanical and tensile strength of the upper substrate of the LCD panel 110 is increased. Thus, it protects the upper substrate and prevents the stylus pen 105 from sliding on the upper surface of the LCD panel 102 when the tip of the stylus pen 105 is touched on the upper surface of the upper substrate of the LCD panel, so that it makes a user comfortable in writing. Then, an antiglare treatment is performed to the PET passivation layer 103 to decrease reflectivity, and a hard-coating treatment is performed to prevent scratches on the upper surface of the LCD panel caused by the tip of the stylus pen 105.

In the LCD device integrated with the digitizer according to the present invention, the passivation layer 103 made of a polyethylene terephthalate (PET) film is

formed on the LCD device 102 without a gap therebetween, so that it protects the upper surface of the LCD panel and improves the mechanical strength, thereby obtaining slim dimension and light weight.

Also, the passivation layer 103 is formed directly on the second polarizing plate 112b of the LCD device 102 without a gap therebetween, so that a visual difference is decreased between the picture images of the stylus pen and the LCD panel 102.

FIG. 9 is a cross-sectional view illustrating an LCM according to the present invention. As shown in FIG. 9, the LCM 110 includes a thin film transistor T which includes a gate electrode 113, a gate insulating layer 114, a semiconductor layer 115, and source/drain electrodes 116a and 116b, a lower substrate 120 which includes a pixel electrode 118, to which a video signal voltage is applied by switching a thin film transistor T, an upper substrate 124 formed to face an opposite direction to the lower substrate 120 and includes a color filter layer 122 for displaying R/G/B color, and a common electrode 123, a liquid crystal layer 125 formed between the upper and lower substrates, and patterned spacers 126 formed on the upper substrate for maintaining a cell gap between the upper and lower substrates.

The patterned spacers 126 are attached to the upper substrate 124 for maintaining a cell gap of the LCM (reference numeral 7 of FIG. 10) so as not to be affected by the external pressure.

Thus, when touching the upper surface of the LCM 110 with the stylus pen, the patterned spacers 126 do not move, so that it maintains a cell gap of the LCD device 102 uniformly, and prevents ripples in the liquid crystal.

Herein, the patterned spacers 126 are formed in the method of depositing a transparent acryl material on the upper substrate for maintaining uniformly the cell gap of the LCD device 102, and selectively removing the transparent acryl material by

photolithography.

[EFFECT OF THE INVENTION]

As mentioned above, the LCD device integrated with the digitizer according to the present invention has the following advantages.

The LCD device integrated with the digitizer according to the present invention is used with an LCD device having patterned spacers, thereby minimizing ripples in the liquid crystal when the LCD device is touched with a stylus pen.

In the LCD device integrated with the digitizer according to the present invention, a polyethylene terephthalate layer is formed on the LCD device, thereby making a user comfortable in writing and providing a slim dimension in the LCD device.

Also, in the LCD device integrated with the digitizer according to the present invention, a contact distance is minimized between a stylus pen and an LCM, thereby decreasing a visual difference.

It will be apparent to those skilled in the art that various modifications and variations can be made in the liquid crystal display device with a digitizer and a method of fabricating the same of the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A liquid crystal display device with a digitizer, comprising:
 - a sensor board for detecting a position of touch point by using a electromagnetic wave;
 - a liquid crystal display device displaying a picture image on the sensor board;
 - a passivation layer made of polyethylene-terephthalate (PET) film on the upper surface of the LCD device for enhancing a mechanical and tensile strength; and
 - a stylus pen for displaying its position over the polyethylene-terephthalate (PET) film.
2. The device as claimed in claim 1, wherein the LCD device includes patterned spacers for maintaining a uniform cell gap between substrates.
3. The device as claimed in claim 1, wherein the polyethylene terephthalate layer is processed with an antiglare treatment.
4. The device as claimed in claim 1, wherein the passivation layer is processed with a hard-coating layer.
5. The device as claimed in claim 1, further comprising:
 - a top case for combining the LCD, the sensor board and the passivation layer altogether; and
 - a shield plate formed below the sensor board for excluding the electromagnetic wave generated from the stylus pen and the sensor board.

6. The device as claimed in claim 5, further comprising:

a digitizer board formed below the shield plate for driving the sensor board; and
a driving circuit positioned below the shield plate for driving the LCD device.

7. The device as claimed in claim 1, further comprising:

a liquid crystal layer formed between an upper and a lower substrate; and
first and second polarizing plates respectively formed on the external surfaces of
the upper and lower substrates; and
a backlight formed below the LCD panel for irradiating the light to the LCD
panel.

8. The device as claimed in claim 7, wherein the passivation layer made of
polyethylene terephthalate film is formed on the first polarizing plate of the LCD.

DRAWINGS

FIG. 1

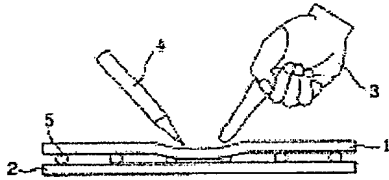


FIG. 2

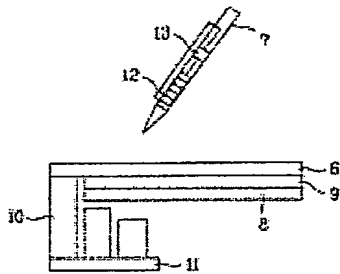


FIG. 3

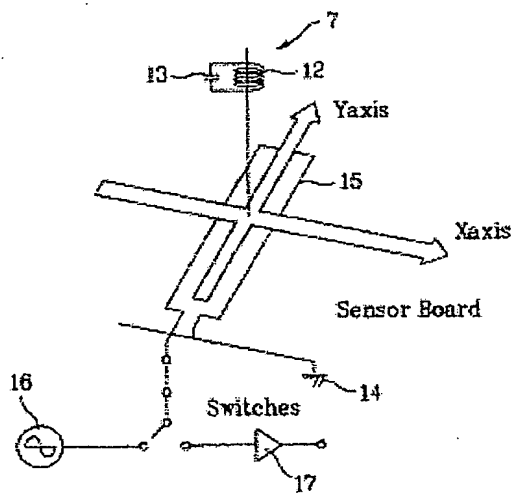


FIG. 4

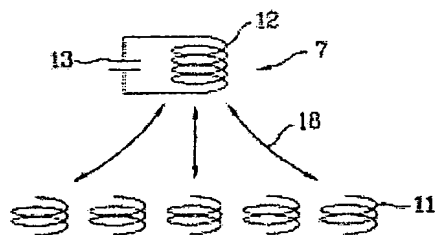


FIG. 5

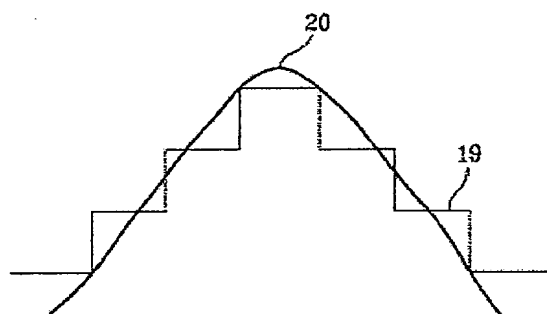


FIG. 6

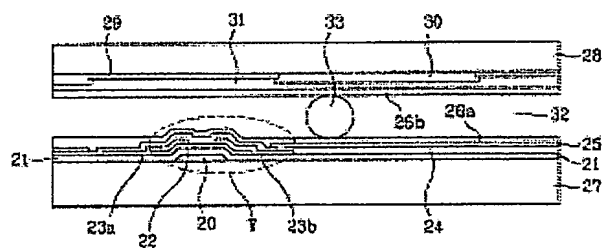


FIG. 7

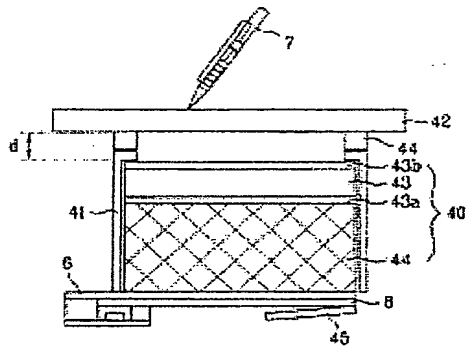
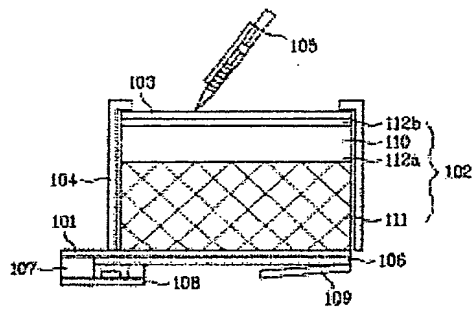


FIG. 8



CERTIFICATE OF VERIFICATION

I, Su Hyun LEE of 648-23 Yeoksam-dong, Kangnam-ku, Seoul, Korea state that the attached document is a true and complete translation to the best of my knowledge of the Korean-English language and that the writings contained in the following pages are correct English translations of the specifications and claims of the Korean Patent Application No. P2002-0083399.

Dated this 31st day of October 2005

Signature of translator: _____



Su Hyun LEE